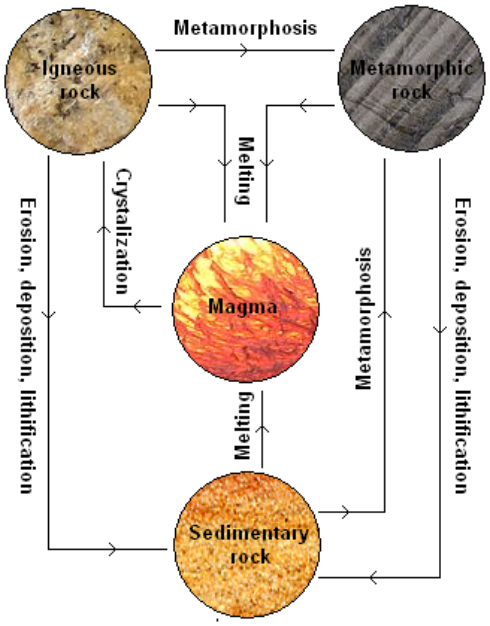
9.1: The Rock Cycle



The Rock Cycle.

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A **rock** is defined as any solid aggregation of minerals. In turn, a **mineral** is any element or inorganic compound that consists of a crystal structure, a specific chemical composition, and a set of distinct physical properties. Over time, rocks experience a variety of forces, including heating, melting, cooling, weathering, and reassembling through the process we call the **rock cycle.** As rocks go through various transformations and alterations, their physical properties undergo a variety of changes.

We classify rocks into three main categories based on how the rocks formed. **Igneous Rocks** formed when **magma**, the hot, molten, liquid form of rock, cools and solidifies. Magma underground cools slowly, forming large crystals. **Intrusive or plutonic rocks**, such as granite, form from the slow cooling of underground magma. **Lava**, magma released by a volcano, can flow along the surface and cools more quickly. Lava on the surface cools faster than underground magma, forming **extrusive or volcanic rocks** such as basalts. Because they solidify faster than plutonic rocks, volcanic rocks have smaller crystals. Large, smooth areas such as the lunar maria, which formed from surface lava flows, are mostly made of basalts, as are many of the younger, smooth areas on Mars.

Magma and lava, the molten form of rock, cool to form igneous rocks.

https:/www.needpix.com/photo/226234/magma-lava-volcano-volcanism-guatemala-liquid-stone-heat-hot;

Sedimentary rocks formed as sediments are pressed together and bound by dissolved materials. **Sediments** are rock particles formed by physical erosion or chemically from precipitation of substances. Wind and water action on rocks weather away tiny particles from rocks through fiction. As sediments pile up over time, their mass can compact the lower levels of sediments, solidifying them into rocks. Sedimentary rocks can also form dissolved minerals precipitating out of solution and becoming cemented together.

Sometimes, on Earth, dead organisms become buried under sediments before they decompose or are eaten by scavengers. Compaction and transformation can then create imprints of the remains of once living fossils in stone called **fossils**.

Sedimentary rocks form in layers as sediments accumulate on top of each other.

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Some sedimentary rocks form through biological processes. For example, a particularly important sedimentary rock for life on Earth is limestone. Limestone is produced in two ways, by a chemical process and as the result of biological activity. The chemical process, the Urey weathering reaction, occurs when carbon dioxide dissolved in water reacts with silicates in rocks. Also, limestone and chalk are also produced by biological processes. The shells of many tiny marine organisms are made of calcium carbonate. When they die, these creatures sink to the bottom of the oceans, and most limestone is probably the result of the gradual compression of the deposits of these shells. Limestone and chalk formation create one of the major reservoirs of carbon dioxide on Earth.

Since sedimentary rocks require weathering as part of their formation, we would not expect to find much evidence of sedimentary rocks on the Moon or Mercury, as these bodies lack a significant atmosphere. On the other hand, Venus and Mars have atmospheres, that can produce wind weather. Since some sedimentary rocks form in the presence of water, these rocks are indicators of liquid water on the surface in the past. So, even though the surface of Mars is very dry today, the presence of rocks and minerals that form in the presences of water would indicate that liquid water once did flow on its surface. Moreover, if we were to find minerals on another planet that require biological activity to form, such as chalk, this would indicate not only the presence of life but also more complex, multicellular life.

The third category of rocks, **metamorphic rocks**, form deep underground as rocks of other types are subjected to great heat or pressure, changing its form. Rocks such as gneiss (pronounced “nice”) form when rocks like marble are transformed due to these underground forces.

Metamorphic rocks form as other rocks are subject to heat and pressure, changing them forms.

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